

CHICKENPOX (Varicella)

✓ DISEASE AND EPIDEMIOLOGY

Clinical Description:

Varicella-zoster virus (VZV) causes two distinctly different clinical diseases, chickenpox and shingles. Below the clinical description is provided for chickenpox (1), including breakthrough varicella (2) and shingles (3).

(1) Chickenpox:

The primary infection is known as chickenpox. It often starts with a mild prodrome of low-grade fever and malaise. After a day or two of prodrome or as the first evidence of illness, the generalized, pruritic (itchy) rash begins along with constitutional symptoms (anorexia, listlessness).

The rash initially appears on the face and trunk, and then spreads to the arms and legs. It may also infect mucous membranes of the oropharynx, respiratory tract, vagina, conjunctiva, and the cornea. It develops into superficial, delicate vesicles that break, leaving open sores that dry and crust over into brown scabs. Chickenpox sores appear in crops, with lesions in several stages of development (maculopapules, vesicles, scabs) present at the same time.

The acute disease lasts from 3-5 days, with resolution of the lesions taking 1-2 weeks.



(2) Breakthrough varicella or Mild varicella-like syndrome (MVLS):

Breakthrough varicella or MVLS refers to infection after exposure to wild-type virus in those who have been previously vaccinated. Studies have shown that breakthrough varicella or MVLS occurs in less than 1-3% of vaccinated children each year following vaccination. Most cases of breakthrough varicella/MVLS in vaccinated children are mild. Patients with breakthrough varicella/MVLS usually have fewer than 50 lesions and they usually do not present with a fever. Cases with breakthrough varicella/MVLS may have a maculopapular rash rather than a vesicular rash. Oftentimes the lesions with breakthrough varicella/MVLS do not scab/crust over. However, it is estimated that as many as 25% of people who develop breakthrough varicella/MVLS may still present with symptoms similar to those in unvaccinated cases.

(3) Shingles:

People who have been infected with VZV can have a reactivation of the infection, which is known as shingles or herpes zoster. Herpes zoster is common among older age groups or those who are immunosuppressed. About 20% of the population will have herpes zoster. This disease presents with vesicular eruptions, typically unilateral and in the dermatome (area of skin) served by a nerve branch, most often on the trunk. Shingles can be quite painful. Disease resolution takes several weeks to a month.

Causative agent:

Chickenpox is caused by the varicella-zoster virus (VZV), a member of the *Herpesvirus* group.

Differential diagnosis:

The differential diagnosis includes smallpox, herpes simplex virus, coxsackie viruses, and impetigo. Smallpox lesions start on the extremities, whereas chickenpox lesions start on the trunk. Smallpox lesions are all in the same stage of development (crop) versus chickenpox lesions that are in different stages of development.

Laboratory identification:

Chickenpox is generally diagnosed clinically. Laboratory testing may be appropriate if the presentation is unusual. Lab test methods include:

Serology:

This is the lowest cost alternative. Both IgG and IgM testing can be performed.

- IgG testing requires that an acute and convalescent serum sample be drawn, 10-14 days apart. The serum should be separated from the cells as soon as possible. Acute and convalescent specimens must be labeled as such; parallel testing is preferred. Transport serum at 2-8°C.
 - NOTE: A single IgG result cannot be used to confirm a varicella case.
- Because results early in the disease may be equivocal, if initial IgM testing is negative, a second sample should be collected 10-14 days after the first. The serum should be separated from the cells as soon as possible. Transport serum at 2-8°C.
 - NOTE: IgM testing is less sensitive than PCR testing on skin lesions. Tests may not be reliable and false negative IgM results are not uncommon. A positive IgM result, although suggestive of a primary infection, does not exclude re-infection or reactivation of latent VZV. Nevertheless, a positive result from a person with a rash is usually interpreted as laboratory confirmation of varicella.

PCR:

This is usually the method of choice for laboratory diagnosis, but may have limited availability and the cost may be prohibitive. Vesicular fluid and scabs are suitable specimens. Vesicular fluid should be collected using a Dacron swab with a plastic shaft (wood, cotton, and calcium alginate may interfere with the test). Each sample should be placed in a snap cap tube or other suitable container. DO NOT place the specimen in transport medium. Samples for PCR may be transported at ambient temperature or at 2-8°C. PCR samples are not suitable for other testing methods. The sensitivity of the test is improved by submitting five specimens from different lesions.

DFA:

This is a lower cost alternative to PCR, but is somewhat less sensitive. Vesicular fluid, tissue, or skin scrapings are all acceptable specimens. The specimen should be immediately placed in viral transport media and be transported at 2-8°C.

Culture:

Because the varicella-zoster virus is difficult to culture, culturing is not routinely recommended. Additionally, results may take several days and are not readily available. Viral culture is recommended for cases of severe disease, particularly in the immunocompromised. Vesicular fluid, tissue, or skin scrapings are all acceptable specimens. The specimen should be immediately placed in viral transport media and be transported at 2-8°C.

UPHL: The Utah Public Health Laboratory can perform PCR, DFA, and culture testing. However, PCR testing is not routinely performed as a diagnostic test to confirm Varicella-Zoster virus infection. If PCR testing is to be requested, UPHL should be contacted before specimen submission.

Treatment:

Several antivirals are active against VZV, including acyclovir, valacyclovir, famciclovir, and foscarnet. Valacyclovir and famciclovir are approved for use only in adults. These drugs may be beneficial if given within 24 hours of rash onset. Studies suggest that they may result in a reduction in the severity of disease and the number of days in which new lesions appear. Antiviral drugs have **not** been shown to decrease transmission of chickenpox, reduce the duration of absence from school, or reduce complications. Antivirals are not recommended for routine treatment of otherwise healthy infants and children.

Antivirals may be considered for:

- Persons older than 13 years
- Persons with a chronic cutaneous or pulmonary disorders
- Persons receiving long-term salicylate therapy
- Children receiving short, intermittent or aerosolized courses of corticosteroids
- Immunocompromised children and adults with viral-mediated complications should receive intravenous administration

Case fatality:

For normal childhood chickenpox, mortality is less than two per 100,000 cases. The risk in adults is 15 times higher. Neonates (usually 5-10 days) and patients with leukemia are susceptible to severe and possibly fatal chickenpox infection, with case fatality rates of 30% and 5-10%, respectively.

Reservoir:

Humans are the only known hosts of VZV.

Transmission:

Chickenpox is primarily spread by droplet or airborne spread of respiratory secretions or vesicle fluid, but may also spread by direct contact with an infected person or contact with an object that has touched a blister's fluid (shirts, pants, etc.). Secondary attack rates among susceptible household contacts can be as high as 90%. Chickenpox is extremely contagious. Immunologically susceptible children/adults can acquire chickenpox from direct contact with herpes zoster lesion fluid.

An immunized person with breakthrough chickenpox disease is about two thirds less contagious than an unimmunized case of chickenpox.

A person with shingles can spread the VZV to others that have never had chickenpox or received the chickenpox vaccine. With shingles, the virus is spread through contact with fluid from the rash blisters and not through sneezing, coughing or causal contact. Shingles is less contagious

than chickenpox and the risk of a person with shingles spreading the virus is low if the rash is covered.

Incubation period:

The incubation period is usually 14-16 days, but can range from 10-21 days.

Period of communicability:

A patient is contagious for roughly 7-10 days starting 1-2 days (sometimes 5) before rash onset, and continuing until scabs have formed on all lesions (usually 5 days after rash onset). Patients with altered immunity may be contagious for a longer period of time.

Susceptibility:

Anyone can catch chickenpox, although it is most common in children under 15 years. Recovery from chickenpox usually results in lifetime immunity to chickenpox. Children who are immunocompromised (especially with leukemia) have a more serious illness that can take longer to resolve.

Epidemiology:

Chickenpox can occur sporadically year-round, however outbreaks occur most frequently in winter and early spring. Chickenpox affects males and females equally, and people of all races are susceptible.

Before the availability of a vaccine, chickenpox mainly affected children, with at least 90% of the population acquiring chickenpox by the age of 15 years. The highest age-specific incidence was among children 1-4 years of age, followed by children 5-9 years of age. Since the introduction of the vaccine, the incidence of chickenpox and disease-related hospitalizations has decreased by 70-80%. Cases have declined across all age groups, but mostly in children 1-4 and 5-9 years of age.

Since 2009, 44% of all chickenpox cases reported to the Utah Department of Health are in children 5-9 years of age, followed by 32% in children 10-14 years of age.

In recent years the number of cases of chickenpox cases reported in Utah has declined a great deal. In 2006, just over 1000 cases of chickenpox were reported to public health. In 2008, 750 cases were reported. In 2010, there approximately 330 cases reported. In 2013, there were approximately 235 cases reported in Utah. Each year since 2009, there have been fewer cases of chickenpox associated with school and daycare facility outbreaks.

PUBLIC HEALTH CONTROL MEASURES

Public health responsibility:

- Prevent illness in high-risk individuals through disease investigation and administration of vaccine.
- Promote vaccination to reduce disease burden in the community.
- Provide education to the general public (regarding disease transmission) and to clinicians (regarding disease diagnosis, reporting, and prevention).
- Monitor disease trends.

- Monitor the impact of vaccination on incidence, morbidity, and mortality.

Prevention:

The most effective control is widespread active immunization.

Chemoprophylaxis:

Persons without evidence of immunity to varicella and who do not have a contraindication to vaccination should be vaccinated. Studies conducted among children showed that vaccine administered within three days of exposure to rash is most effective in preventing disease ($\geq 90\%$); however, vaccine administered within five days of exposure to rash is about 70% effective in preventing disease and 100% effective in modifying disease. In a varicella outbreak setting, ongoing exposures are likely and may continue for weeks and even months. Thus, to limit disease transmission during an outbreak and to provide protection against subsequent exposures, ACIP recommends that all persons without evidence of immunity to varicella be offered vaccine even if more than five days have passed since first exposure to the disease.

School settings. One dose of the varicella vaccine has been successful for outbreak prevention and control in school settings. If a person is unvaccinated and receives one dose of the vaccine, that person may immediately return to school after vaccination. If a person has already had one dose of the vaccine previously, a second dose is recommended for outbreak control. Children who are vaccinated with a first or second dose during an outbreak may immediately return to school after vaccination. For outbreaks among preschool-aged children in particular, a second dose of varicella vaccine is recommended to provide optimal protection for children 1-4 years of age.

Varicella-zoster immune globulin (VariZIG) was approved by the FDA in December of 2012 for use in the U.S. for post exposure prophylaxis of varicella for persons at high risk for severe disease who lack evidence of immunity to varicella and for whom varicella vaccine is contraindicated. VariZIG can prevent chickenpox if given within 10 days of exposure. (Note: FDA approved the 10 day time frame from four days in May 2011. VariZIG should be administered as soon as possible following varicella-zoster virus exposure, ideally within 96 hours (four days) for greatest effectiveness.

It is recommended for use in high-risk persons including:

- Immunocompromised patients without evidence of immunity to VZV.
- Newborn infants whose mothers have signs and symptoms of varicella around the time of delivery (i.e., five days before to two days after).
- Hospitalized premature infants born at ≥ 28 weeks of gestation whose mothers do not have evidence of immunity to varicella.
- Hospitalized premature infants born at < 28 weeks of gestation or who weigh $\leq 1,000$ g at birth, regardless of their mother's evidence of immunity to varicella.
- Pregnant women without evidence of immunity.

VariZIG Administration

VariZIG is supplied in 125-IU vials and should be administered intramuscularly as directed by the manufacturer. The recommended dose is 125 IU/10 kg of body weight, up to a maximum of 625

IU (five vials). The minimum dose is 62.5 IU (0.5 vial) for patients weighing ≤ 2.0 kg and 125 IU (one vial) for patients weighing 2.1–10.0 kg (2).

VariZIG can be ordered from the exclusive U.S. distributor, FFF Enterprises (Temecula, California) (telephone, 800-843-7477; online at <http://www.fffenterprises.com>)

For dosage and administration recommendations, please reference MMWR 55(08);209-210 <http://www.cdc.gov/mmwrR/preview/mmwrhtml/mm5508a5.htm>.

Varicella vaccine should be administered at five months or longer after VariZIG administration. Because varicella zoster immune globulin might prolong the incubation period by one week or longer, any patient who receives VariZIG should be observed closely for signs and symptoms of varicella for 28 days after exposure. Antiviral therapy should be instituted immediately if signs or symptoms of varicella occur. Most common adverse reactions following VariZIG administration were pain at injection site (2%) and headache (2%). Contraindications for VariZIG administration include a history of anaphylactic or severe systemic reactions to human immune globulins and IgA-deficient patients with antibodies against IgA and a history of hypersensitivity.

Vaccine:

Vaccination is the primary method of prevention. A live, attenuated vaccine has been available since 1995. It is recommended that the following groups be vaccinated:

- All children less than 13 years of age should routinely be given two doses of varicella-containing vaccine. The first dose should be given at 12-15 months of age and the second at 4-6 years of age. The second dose can be given at an earlier age provided it has been at least three months since the first dose. However, if the second dose is given at least 28 days after the first, the second dose does not need to be repeated.
- A second dose catch-up varicella vaccination is recommended for children and adolescents who previously had received one dose. Catch-up second dose can be administered at any interval longer than three months after the first dose.
- All other individuals 13 years of age and older without evidence of immunity should be vaccinated with two doses of varicella vaccine separated by 4-8 weeks.

For the 2014-2015 school-year in Utah, students entering kindergarten or seventh are required to have two doses of the chickenpox vaccine. A child one year of age and older attending an early childhood program must have received one dose of the chickenpox vaccine prior to entry. For more information regarding the vaccination requirements in Utah for the 2014/2015 see the “Utah Immunization Guidebook” available at http://www.immunize-utah.org/pdf/Immunization_Guidebook.pdf.

Chickenpox vaccine is 80%–85% effective against infection and more than 95% effective against severe disease. Breakthrough infection (chickenpox in a vaccinated individual) can occur, but is usually milder with fewer lesions. Children with breakthrough chickenpox usually do not have a fever, tend to be out of school for a shorter amount of time than children with natural infections, and have lesions that generally do not blister and scab.

A majority (97%) of healthy children less than 13 years of age will develop detectable levels of antibody after one vaccination; however, only 80% of persons 13 years of age and older will respond to a single dose. Two doses administered 4-8 weeks apart for persons 13 years of age and older produces detectable levels of antibodies in 99% of vaccinees.

A vaccine for shingles was licensed in 2006 and recommended for persons 60 years of age and older. The vaccine reduces the risk of shingles by 51% and the risk of post-herpetic neuralgia (a painful complication of shingles) by 67%. Vaccine efficacy lasts for at least three years, although the ultimate length of efficacy is unknown.

Isolation and quarantine requirements:

Isolation: Non-hospitalized patients should be voluntarily isolated in their house until all of their lesions have scabbed over.

For children with suspected **breakthrough varicella** consisting of only a maculopapular lesion and occurring greater than 42 days after receiving a vaccine dose, isolation from school or childcare is recommended until 24 hours have elapsed since the appearance of any new lesions. As lesions in these children may not form crusts, parents do not have to wait for crusting to occur or for the lesion to completely resolve before the child can resume physical and social contact with others. (American Academy of Pediatrics. Varicella-zoster infections. In: Pickering LK, ed. Red Book: 2012 Report of the Committee on Infectious Diseases. 29th ed. Elk Grove Village, IL: American Academy of Pediatrics; 2012:774-789)

Hospital: Airborne and contact isolation is required of all chickenpox cases until all lesions are crusted. Only immune individuals should care for the patient. VariZIG should be considered for susceptible high-risk contacts of the sick person.

Quarantine: Only in the school setting should contacts of cases be routinely quarantined. Recommendations follow in the *School/childcare outbreak control recommendations* section.

School/childcare outbreak control recommendations:

One Case Identified

Persons with symptoms should be excluded from school/childcare until all lesions have scabbed over, even if no laboratory confirmation is performed or an outbreak is not recognized.

Optional: Parents of vaccine-exempt students should be notified of their child's possible exposure once **one** case of chickenpox occurs in the school.

Optional: Parents of students in the same kindergarten class or grade level of a chickenpox case should be educated on the signs and symptoms of the disease, the availability of a second dose of vaccine, told to keep children home if they suspect they are ill, and to inform the school if their child has chickenpox.

Outbreak Definition

Schools and childcare facilities are the most common sites for chickenpox outbreaks. A chickenpox outbreak in a school setting is defined as:

- Five or more cases within a two month period in the same school facility

An outbreak is considered over when no new cases occur within two months from the date the last case was considered infectious.

Note: Because daycares, after school programs, preschools, Head Start programs, charter schools, and private schools can differ significantly from traditional public school settings, the Local Health Department may make adjustments to the outbreak definition for settings where it is deemed necessary.

A Confirmed Outbreak

Once an outbreak is confirmed, parents should be notified of their child's possible exposure to chickenpox. They should be educated on the signs and symptoms of the disease, the availability of a second dose of vaccine, told to keep children home if they suspect they are ill, and to inform the school if their child has chickenpox. Teachers and other school employees should also be educated on the signs and symptoms of chickenpox. Children with signs and symptoms should be sent home and encouraged to consult a medical professional. Pregnant teachers and employees should be identified, and their immune status determined. Those without an appropriate immune history should be encouraged to consult with a medical professional. Laboratory diagnosis is not necessary (or even required) to make a chickenpox diagnosis!

Exclusions of vaccine-exempt students should occur once at least five cases have occurred within a two month period among students in the same kindergarten class or grade level. Exclusions should only be made to students within the same kindergarten class and grade level. Vaccine-exempt students should remain out of school for days 10-21 after the last known case is considered non-infectious. Days 10-21 are the critical days for vaccine-exempt students to be out of school, however, local health departments may choose to exclude students for the full 21 days after exposure to simplify the exclusion policy. Vaccination within three days, and possibly five days, of exposure has been shown to prevent or reduce the severity of disease. However, since an adequate immune response can take up to two weeks to develop, disease may still result even if vaccination occurs soon after exposure. Parents should still be cautioned to watch for signs of illness even if their child receives the vaccine within five days of exposure, and should keep the child home if they suspect their child is ill. If parents of vaccine-exempt students choose to vaccinate their children, the exclusionary period does not apply and students may return to school as soon as they are vaccinated.

Since the 2006-2007 school year in Utah, all students in kindergarten through 4th grade as well as 7th graders are required to be vaccinated for chickenpox. Exclusions do not apply to students without a vaccination requirement, although any sick child, regardless of vaccination requirement, should be excluded until all lesions have scabbed.

Current CDC recommendations for dealing with chickenpox outbreaks can be found here:
<http://www.cdc.gov/chickenpox/outbreaks/manual.html>

R396-100-8. Exclusions of Students Who Are Under Exemption and Conditionally Enrolled Status.

(1) A local or state health department representative may exclude a student who has claimed an

exemption or who is conditionally enrolled from school attendance if there is good cause to believe that the student has a vaccine preventable disease and:

(a) has been exposed to a vaccine-preventable disease; or

(b) will be exposed to a vaccine-preventable disease as a result of school attendance.

(2) An excluded student may not attend school until the local health officer is satisfied that a student is no longer at risk of contracting or transmitting a vaccine-preventable disease.

A Prolonged Outbreak

Because persons can be infectious before symptoms appear, exclusions can have a limited value on preventing transmission. Outbreaks in the school setting have been documented to persist for up to 6 months. Chickenpox vaccination has been effective in controlling chickenpox outbreaks. ACIP now recommends that a second dose of vaccine be offered to exposed persons with a history of one dose of chickenpox vaccine, providing that the appropriate time interval has passed since the first dose (three months for people 12 months to 12 years of age and at least four weeks for people ≥ 13 years of age).

Optional: A second dose of vaccine should be recommended to all students if cases are still being diagnosed 60 days after the initial rash onset of the first identified case, or once 20 cases have been identified. Efforts should be focused on students with active cases in their kindergarten class or grade level or siblings of active cases.

The Local Health Department may evaluate individual cases and outbreaks to make any necessary adjustments to exemptions.

CASE INVESTIGATION

Reporting:

Chickenpox should be reported within three working days of identification to the local health department or the Utah Department of Health. Herpes zoster is not a reportable condition.

Criterion	Reporting
<i>Clinical Evidence</i>	
Generalized maculo-papulovesicular rash	S
Healthcare record contains a diagnosis of varicella	S
Death certificate lists varicella as the cause of death or a contributing cause of death	S
<i>Laboratory Evidence</i>	
Isolation of varicella virus from a clinical specimen	S
Positive direct fluorescent antibody (DFA) for varicella from a clinical specimen	S
Positive polymerase chain reaction (PCR) for varicella-specific nucleic acid	S
A significant rise in serum varicella immunoglobulin G (IgG) antibody level by any standard serologic assay	S

Notes: S = This criterion alone is sufficient to identify a case for reporting.

Case definition:

Varicella (Chickenpox) (2009):

Clinical Case Definition

An illness with acute onset of diffuse (generalized) maculo-papulovesicular rash characteristic of varicella, without other apparent cause

Laboratory Criteria

- Isolation of VZV from a clinical specimen, OR
- Direct fluorescent antibody (DFA), OR
- Polymerase chain reaction (PCR), OR
- Significant rise (at least a 4 fold rise) in serum varicella IgG antibody level.

- **Narrative description of criteria to determine whether a case should be classified as confirmed or probable (presumptive).**

Case classification

Probable:

- An acute illness with
 - diffuse (generalized) maculo-papulovesicular rash; and
 - lack of laboratory confirmation; and
 - lack of epidemiologic linkage to another probable or confirmed case.

Confirmed:

- An acute illness with diffuse (generalized) maculo-papulovesicular rash; and
 - epidemiologic linkage to another probable or confirmed case, or
 - laboratory confirmation by any of the following:
 - isolation of varicella virus from a clinical specimen; or
 - varicella antigen detected by direct fluorescent antibody test; or
 - varicella-specific nucleic acid detected by polymerase chain reaction (PCR); or
 - significant rise in serum anti-varicella immunoglobulin G (IgG) antibody level by any standard serologic assay.

Notes:

Two probable cases that are epidemiologically linked would be considered confirmed, even in the absence of laboratory confirmation.

In vaccinated persons who develop varicella more than 42 days after vaccination (breakthrough disease), the disease is almost always mild with fewer than 50 skin lesions

and shorter duration of illness. The rash may also be atypical in appearance (maculopapular with few or no vesicles).

Laboratory confirmation of cases of varicella is not routinely recommended; laboratory confirmation is recommended for fatal cases and in other special circumstances.

Criterion	Confirmed		Probable
<i>Clinical Evidence</i>			
Acute illness with diffuse (generalized) maculopapulovesicular rash	N	N	S
<i>Laboratory Evidence</i>			
Isolation of varicella virus from a clinical specimen		O	
Detection of varicella antigen by direct fluorescent antibody test;		O	
Detection of varicella-specific nucleic acid by polymerase chain reaction (PCR)		O	
Significant rise in serum anti-varicella immunoglobulin G (IgG) antibody level by any standard serologic assay		O	
<i>Epidemiologic Evidence</i>			
Contact of a confirmed or probable case of varicella infection	O		
Member of a risk group as defined by the public health authorities during an outbreak	O		

Notes:

S = This criterion alone is sufficient to classify a case.

N = All —"N" criteria in the same column are necessary to classify a case.

O = At least one of these —"O" (optional) criteria in each category (i.e., clinical evidence and laboratory evidence) in the same column—in conjunction with all —"N" criteria in the same column—is required to classify a case.

✓ INVESTIGATION PROCESS FOR HIGH-RISK CASES OR EXPOSURES

The majority of chickenpox case investigations will not require any case management or contact tracing. In the event that a case is identified in a person at high-risk for complications or in a setting where persons at high-risk for complications may have been exposed, the local health department may choose to more thoroughly investigate.

Case management:

Treatment:

Determine if case is at high-risk for complications.

- Persons older than 13 years of age
- Persons with a chronic cutaneous or pulmonary disorders
- Persons receiving long-term salicylate therapy
- Children receiving short, intermittent or aerosolized courses of corticosteroids

- Immunocompromised children and adults with viral-mediated complications should receive intravenous administration of VariZIG or IGIV

Consider antiviral treatment if at high-risk.

Isolation:

Children with chickenpox should be excluded from school or child-care settings until all lesions have crusted over. Voluntary isolation from work and other settings where close contact may transmit the disease is desirable. Educate patient to refrain from contact until all lesions have crusted over. Follow the isolation and quarantine requirements (listed above) for health care workers or residents in a hospital or long term care facility.

Education:

Provide an educational fact sheet to the patient (or parent of the patient). If the patient works at or attends a childcare or school, work with the school administration to send notification letters to other students/parents/teachers as necessary.

Identify case contacts:

Close contacts are people who have the following contact with the case patient during the infectious period (7-10 days starting 1-2 days [sometimes five] before rash onset until scabs have formed on all lesions [usually five days after rash onset]).

- Household and immediate family members (those who spend many hours together or sleep under the same roof);
- Those who have direct contact with respiratory secretions;
- Those who have direct or indirect contact with blister fluid;
- Healthcare workers with face-to-face contact with a patient; and
- Those who share confined space during the communicable period. Such contacts may include:
 - Core groups of close friends, social contacts, boyfriends, girlfriends,
 - Students within the same kindergarten class or grade level,
 - Contacts at church activities and employment,
 - Participants in extracurricular activities (such as fieldtrips), and
 - Children attending after-school care or a playgroup.

Healthcare personnel:

All healthcare workers (HCWs) should be immune to chickenpox either through natural infection or vaccination. HCWs without a reliable history should have laboratory documentation of seroconversion. If a susceptible HCW is exposed to VZV, they should be furloughed from work for days 10-21 after exposure. Because receipt of VariZIG can prolong the incubation period by one week, susceptible employees receiving VariZIG should be furloughed for days 10-28 after exposure. Because of the possibility of breakthrough disease, several options for monitoring vaccinated HCWs that are potentially exposed to VZV exist. Serological testing for immunity immediately after exposure is recommended. Those with detectable antibodies are unlikely to become infected. Persons without detectable antibodies may be retested in 5-6 days. If detectable antibodies are present, these persons are unlikely to become ill. If a HCW is tested twice, and both times antibodies are not detected, the HCW may be furloughed for days 10-28 after exposure or monitored daily for symptoms of chickenpox.

Case contact management:

Asymptomatic contacts:

- Exclude vaccine-exempt children without history of disease from school/childcare or contact with children when necessary.
- Recommend vaccine to susceptible persons.
- Recommend medical consultation for exposed susceptible persons at high-risk of severe disease (VariZIG may be warranted).
- Provide educational materials informing of exposure and recommending vaccination.

Symptomatic contacts:

- Exclude from school/childcare settings until infectious period has passed.
- Consider vaccination of susceptible persons to lessen disease severity.
- Consider treatment of active cases with antiviral therapy (adolescents, adults, and high-risk only).
- Provide educational materials informing of exposure.

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